

Bic Lab (Molar Mass of Butane Lab)

Pre-AP Chemistry v. Spring2018

Purpose: The purpose of this lab is to experimentally determine the molar mass of a sample of butane (C_4H_{10}) gas. Using the ideal gas law and the data collected, the experimental molar mass of the butane (C_4H_{10}) can be determined and compared to the calculated molar mass of butane (C_4H_{10}) which is 58.1 g/mol.

Materials:

- 5-20L bucket or bin with a minimal cross-section of 30cm
- Butane Lighter
- 100mL Graduated Cylinder (Glass)
- Electronic Balance (0.00 or 0.000)
- Thermometer
- Barometer

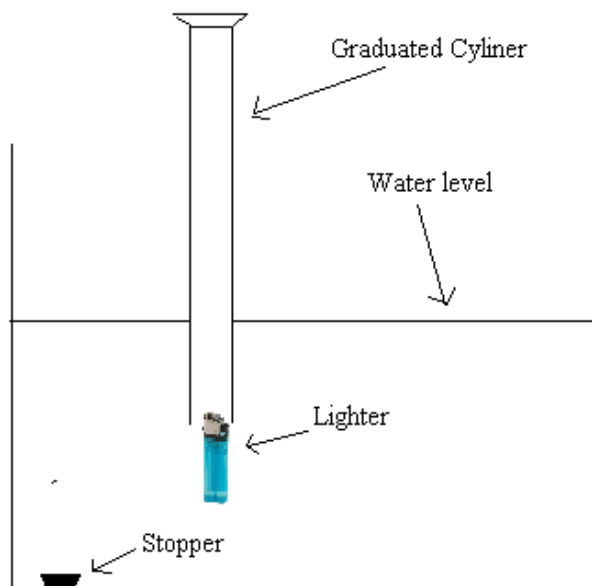
Pre lab Questions:

1. What is the balanced equation for the combustion of butane gas?
2. If the density of a gas is found to be 717g/L at 25°C and 1031atm, what is the molar mass of the gas be?
3. 40.0g of gas from pre-lab #2 was brought to STP conditions, what is the new density of the gas (g/L)?

Procedure:

1. Fill a stopped sink or bucket 2/3 with water. (Let it sit so water temp. = room temp.)
2. Put the lighter under the water for about 30 seconds, then take out of water, **dry it off completely** and take the mass of the lighter. (get initial mass of lighter from Mr. Golden and record lighter ID# and Mass)
3. Fill the graduated cylinder with water (make sure there are no air bubbles in the cylinder)
4. Invert the graduated cylinder into bucket of water.
5. Take the butane lighter and hold it under the Graduated cylinder (gas collection tube). (Diagram 1)
6. Release ~75ml of the butane (C_4H_{10}) gas collection tube.
7. Raise the level of the gas collection tube to make sure the water level in the gas collection tube matches the water level of the water in the bucket **or** add water to the bucket to raise the bucket water level to the gas collection tubes level.
8. Record the volume of the butane gas (ml).
9. **Only complete step 9 if your gas collection tube is glass.** Take the gas collection tube out of the water. Aim the mouth of the gas collection tube away from your face and light it with the Bunsen burner.
10. Dry the lighter and take the mass of the lighter again. Insure to not release any butane once you remove the lighter from under the gas collection tube.
11. Wait 5min and take mass again of lighter.
12. Determine and record the room temperature using the thermometer and the water.
13. Record the pressure of the room written on the board.

Diagram 1



Mass of Lighter before (g)	
Mass of Lighter after #1(g)	
Mass of Lighter after #2(g)	
Mass of butane released (g)	
Volume of butane (ml)	
Volume of butane (L)	
Room Temperature ($^{\circ}\text{C}$)	
Room Temperature (K)	
Air Pressure (atm.)	
Water Vapor Pressure (atm.)	
Pressure of Butane Gas (atm.)	

Data Table (Measurements and Calculations)

Conclusion Questions:

1. Using the ideal gas law ($PV=nRT$), determine the molar mass of the sample of gas collected (Molar Mass = g/mol).

2. If the actual molar mass of the butane gas collected is 58.1 g/mol, using your experimental value calculated in the lab, what is the percent error of your experiment?

$$\text{Percent Error} = \frac{\text{Actual} - \text{Experimental}}{\text{Actual}} \times 100$$

3. How accurate was your experiment, if you had error what do you think was the cause of it?

4. Why did you make sure that the level of the water in the graduated cylinder was at the same level as the water surrounding the graduated cylinder in the sink?

Bonus: Record the color that the butane gas emitted when it was lit on fire and explain why the butane gas lit was a different color than most fires that you observe.